

GAO

Report to the Chairman, Committee on
Governmental Affairs, U.S. Senate

June 1993

NUCLEAR NONPROLIFERATION

Japan's Shipment of Plutonium Raises Concerns About Reprocessing



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Resources, Community, and
Economic Development Division

B-253123

June 14, 1993

The Honorable John Glenn
Chairman, Committee on
Governmental Affairs
United States Senate

Dear Mr. Chairman:

On January 4, 1993, the Japanese ship Akatsuki Maru, along with the armed escort ship Shikishima, completed a 2-month voyage in which it transported 1.7 tons of plutonium oxide from Cherbourg, France, to Tokai, Japan. This was the first in a series of shipments of recovered plutonium that Japan has proposed under the 1988 Agreement for Cooperation Between the United States and Japan Concerning Peaceful Uses of Nuclear Energy (the Agreement). The plutonium had been recovered, or reprocessed, at France's reprocessing facility in La Hague from spent (used) nuclear fuel that Japan had originally obtained from the United States to generate commercial nuclear power. Under the Agreement, Japan was required to fulfill certain conditions to ensure the physical security and safety of the shipment.

This report responds to your July 1992 request for information about the Akatsuki Maru shipment. Specifically, the report discusses the physical security (protection from attack or diversion) and safety (prevention of accidents) of the shipment, as well as any costs to the United States resulting from the shipment. In addition, the report discusses the broader concerns raised by the shipment, including concerns about reprocessing and the resulting growth in the world's stocks of plutonium. Finally, the report discusses the implications of the Agreement for future U.S. nuclear agreements.

Results in Brief

As required by Annex 5 of the 1988 Implementing Agreement Between the United States of America and Japan (the Implementing Agreement), Japan prepared a transportation plan for a shipment from France to Japan of recovered plutonium of U.S. origin. This plan documented specific arrangements for the shipment, assessed potential threats to the shipment, and identified actions to be taken in response to any threats. Officials from six U.S. agencies reviewed the plan, and in September 1992, the United States sent a "letter of assistance and cooperation" to Japan, thereby approving Japan's plan to ensure a secure shipment.

Both the ship that transported the plutonium and the containers that held it either met or exceeded international standards for transporting nuclear materials. The Akatsuki Maru was double-hulled and was specially equipped and retrofitted to ensure a safe and secure voyage. According to an official of the International Maritime Organization (IMO), which regulates maritime safety in international waters, the vessel was built above IMO's suggested standards.

According to U.S. officials, the costs incurred by the United States for its role in the shipment were mainly for the time that executive branch agency staff worked with Japanese officials to develop and review Japan's transportation plan and for a few short trips to Japan to review physical security procedures. Agency officials said that their records do not track the time allotted to specific tasks and that the costs arose from their routine duties and responsibilities. Furthermore, they told us that U.S. involvement was minimal after the plan was accepted. According to the Department of Defense (DOD), U.S. forces were informed when the ship passed by U.S. bases along its route, but no equipment was deployed to support the shipment.

Because plutonium can be used to make a nuclear weapon, the voyage of the Akatsuki Maru raised concerns both at home and abroad about the security and safety of the shipment—primarily about the risk that it might be captured by a terrorist group or that persons might be exposed to its toxic effects in case of an accident. In the United States, these concerns were reflected in a requirement, in section 2904 of the Energy Policy Act of 1992, that the President, in consultation with the Nuclear Regulatory Commission (NRC), conduct a study of the safety of shipping plutonium by sea. Other nations expressed their concerns about the shipment through requests to Japan's government that the ship not enter their territorial waters.

Japan's shipment revived public concern about both the amount of plutonium that is being and will be generated from commercial reprocessing and the risk that it may be diverted to states that do not have nuclear weapons. Two other countries have requested agreements with the United States similar to the one with Japan, and agreements on related issues will be coming up for congressional consideration. According to State Department officials, the United States strongly discourages reprocessing in other countries (except in Japan and western Europe), but it may in some cases provide alternative nuclear technologies to satisfy related needs. For example, if a nation requests reprocessing technology

to dispose of spent fuel, U.S. officials may share spent fuel disposition technologies, but not reprocessing technology. The Agreement differs from nuclear cooperation agreements between the United States and other countries by providing prior consent for 30 years for the return of separated plutonium to Japan. Unlike in these other agreements, the Congress is not given the opportunity to modify or disapprove the return of plutonium on a case-by-case basis, and therefore its oversight opportunities are diminished.

Background

Japanese officials plan to use the January 4, 1993, shipment of plutonium to fuel Japan's Power Reactor and Nuclear Fuel Development Corporation's (PNC) demonstration fast breeder reactor. Because its reprocessing capability does not meet its anticipated plutonium needs, Japan entered into long-term reprocessing contracts to recover plutonium from Japanese spent reactor fuel of U.S. origin. These contracts are with Cogema, a French government-company, and with British Nuclear Fuels Limited (BNFL), a company owned by the government of the United Kingdom that is responsible for developing and operating nuclear fuel cycle facilities. These companies' reprocessing facilities are located at La Hague, France, and Sellafield, England, respectively. Reprocessing is the chemical separation of usable uranium and plutonium from spent nuclear power reactor fuel. The recovered plutonium can be recycled as fuel for reactors, reducing the demand for uranium ore. The major disadvantage of reprocessing is that the plutonium recovered through it can be used to construct a nuclear weapon.

Japan plans to transport the spent fuel from its reactors to Europe and to ship the recovered plutonium back to Japan over the 30-year life of the Agreement. Eventually, Japan expects to meet its anticipated reprocessing needs through its reprocessing facilities at Tokai and Rokkasho and through an additional planned facility to be built in Japan. Shortly after the year 2000, Japan intends to reach full capacity at its Rokkasho reprocessing plant, which is expected to recover 4.5 to 5 metric tons of plutonium per year. According to Japan's Atomic Energy Commission, Japan's total supply of plutonium through the year 2010 will be 85 metric tons, including plutonium recovered both at home and abroad.

U.S. Officials Assured of Physical Security and Safety of Shipment

The Agreement requires Japan to satisfy certain conditions regarding the security and safety of any shipments of plutonium of U.S. origin. First, Japan must notify the United States that such a transfer shall occur. Annex 5 of the Implementing Agreement requires Japan to follow specific guidelines for the international transportation of recovered plutonium. These guidelines stipulate that, before each shipment, Japanese officials submit to the United States a transportation plan to document specific arrangements to be implemented in each shipment. According to U.S. officials, the plan includes a threat assessment to identify possible physical security risks and a contingency plan to document the actions to be taken in such situations by the crew, the escorts, and the operations center personnel.

Second, according to State Department officials, the Japanese government submits the plan to U.S. officials for review before it is finalized. If the United States is not satisfied with the manner in which certain physical security requirements have been addressed and if, after discussions, Japan does not wish to alter its arrangements, the United States can stop the shipment only if (1) it determines that such transfers would pose a threat to national security and/or (2) there is proof that the transfers will significantly increase the risk of proliferation of nuclear materials.

Officials of six U.S. agencies reviewed the transportation plan submitted by Japan and were satisfied with the final physical security arrangements. In September 1992, the United States submitted a "letter of assistance and cooperation" to Japan, indicating, in essence, that U.S. officials had determined that Japan's plan met the Agreement's requirements. The negotiations between Japan and the U.S. agencies took place between 1988 and 1992 and included reviews of many draft plans before the shipment's departure in November 1992. State Department officials led the review and received technical support from the Arms Control and Disarmament Agency (ACDA), DOD, the Department of Energy (DOE), NRC, and the U.S. Coast Guard.

The State Department used the advisory capabilities of these other U.S. agencies to evaluate and suggest improvements to the security and safety measures discussed in the final plans. U.S. officials used general guidelines to determine the level of protection needed to prevent a compromise in security for these types of shipments and applied these guidelines in reviewing the plans for the 1992 shipment. DOD officials primarily reviewed and assisted in developing the threat assessment and physical security measures. DOD officials said that Japanese officials incorporated DOD

advice into their plans and, as a result, DOD officials were satisfied that the final plans could adequately address the risks posed by the shipment. DOD also tracked the shipment and passed data on the ship's location to the military officials responsible for the regions through which the ship passed. DOE officials discussed nuclear safety and security concerns with Japanese officials, reviewed the plans, and provided technical expertise. An ACDA official reviewed the transportation plan but did not independently assess the adequacy of the plan.

NRC officials provided technical assistance regarding the adequacy of physical protection measures in the transportation plan, the completeness of the threat assessment, and the inclusion of the proper set of events and associated emergency responses in the contingency plan. In particular, NRC made certain that the plan contained appropriate measures for protecting the shipment's physical security, including measures for ensuring the availability of an external response force. In addition, NRC officials reviewed the plan to ensure that the shipment was as well protected at sea as on land and met requirements for the physical protection of similar nuclear material.

Finally, because some potential shipping routes could be near U.S. territories or Hawaii, the Coast Guard was involved in the planning in case the transport ship requested entry into a U.S. port or had an accident that could threaten the plutonium cargo while in U.S. waters. In either case, the Coast Guard could deny or grant the transport ship entry into U.S. waters or ports.

U.S. Officials Were Satisfied With Ships and Equipment

U.S. officials agreed that the two ships carried the best and most technologically advanced equipment available. Built expressly for transporting nuclear materials, the Akatsuki Maru was owned jointly by BNFL and a subsidiary and was used to transport spent fuel. The ship was doubled-hulled and equipped with special fire-fighting, radiation safety, navigation, and communications equipment. In addition, the ship's on-board cranes, used to lift the hatch covers sealing the storage area within the ship, were rendered inoperable so that the containers of plutonium could not be removed during transport. The transport ship was staffed by a selected crew, nuclear specialists, and teams of armed officers from the Japanese Maritime Safety Agency.

The Senior Technical Officer of the Maritime Safety Division, IMO,¹ told us that the Akatsuki Maru complied with the draft IMO code for the safe transport of nuclear materials and was built above IMO regulations. Moreover, the Akatsuki Maru met Japanese national domestic shipping regulations, which are more stringent than the IMO code. Generally, he noted that IMO would like to see these standards applied to all ships transporting nuclear material. In addition, the packaging used to transport the plutonium was a French-manufactured container that exceeded international packaging standards for nuclear materials, according to the Attaché for Nuclear Energy, French Atomic Energy Commission. Appendix I contains additional information on international standards for transporting nuclear materials.

The Shikishima, an armed escort ship newly built for Japan's Maritime Safety Agency specifically to guard plutonium transport ships, accompanied the Akatsuki Maru. U.S. officials helped Japanese officials develop security plans for the Shikishima. The 6,500-ton escort ship was equipped with two helicopters, two speedboats, dual rapid-fire 35 mm gun turrets fore and aft and 20 mm vulcan guns port and starboard. DOD and DOE officials toured the ship in Japan and were satisfied that the ship met the physical security commitments described in the transportation plan. Photographs of the Akatsuki Maru and the Shikishima appear in appendix II.

U.S. and Japanese Officials Confer on Physical Security Standards

In addition to reviewing physical security measures for the shipment itself, U.S. officials have obtained information about physical security measures within Japan's nuclear facilities. Because only about 8 kilograms of plutonium in its metallic form is needed to make a bomb, physical security measures are used to prevent or detect the diversion of small amounts of plutonium. Although the shipment contained plutonium oxide, a powder form, an industry expert told us that converting plutonium oxide into a metallic form is relatively simple.

Physical protection specialists from DOE and NRC have toured Japan's nuclear facilities to exchange technical information about the physical security measures used at these facilities and during the transport and storage of nuclear material within Japan. In return, at the invitation of the United States, Japan sent teams to visit U.S. nuclear facilities to learn about U.S. physical security measures. Furthermore, Japan has concluded

¹IMO is a specialized agency of the United Nations created to improve maritime safety and prevent marine pollution in oceans and seas.

full-scope safeguards agreements with the International Atomic Energy Agency (IAEA)² and has accepted IAEA inspections. In 1990, 25 percent of all IAEA safeguards inspections took place in Japan.

U.S. Officials Cite Minimal Costs and Involvement in the Shipment

According to U.S. officials, U.S. involvement in the recent shipment was minimal after agency officials accepted the transportation plan. DOD tracked the ship's progress and passed location data to the appropriate military officials responsible for the region in accordance with procedures developed for the shipment. However, according to the Country Director for Japan in DOD's Office of International Security Affairs, East Asia and Pacific Region, military officials took no action to reposition military forces or to train personnel specifically in preparation for or in reaction to the shipment.

In 1984, Japan completed a similar shipment of plutonium of U.S. origin from France, for which the French and U.S. militaries provided security. According to a DOD official, the U.S. Navy absorbed the costs of providing security. A 1988 DOD technical evaluation of alternative routes for the sea transport of plutonium pointed out that for all future shipments, the costs to the U.S. government would be limited to the costs of monitoring, inspecting, and certifying that security procedures were adequate. Japan would pay for any needed modifications to the transport ship, such as adding fuel capacity and providing special equipment to meet physical security requirements, as well as for the normal shipping costs and costs for fuel, other provisions, and crew.

Agency officials told us that the only costs incurred by the United States for Japan's most recent transport were for staff to review and negotiate the plan, take several short trips to Japan to review physical security procedures, and monitor the shipment. DOD, DOE, NRC, and State Department officials said that their records do not track allotments of time among various tasks and that any estimate would be conjectural. State Department officials told us that any costs that were incurred arose from what they considered their routine roles and responsibilities. However, DOD's Country Director for Japan told us that one DOD official had traveled to Tokyo in June 1992 specifically to discuss this shipment with Japanese officials. Travel and per diem costs for this official amounted to \$3,153.

²IAEA is an independent intergovernmental organization within the United Nations whose objectives are to (1) accelerate and enlarge the contribution of atomic energy to peace, health, and prosperity throughout the world and (2) ensure so far as it is able that any assistance it provides, is requested to provide, or is under its supervision or control is not used to further any military purpose.

In addition, during the conduct of the shipment, DOD monitored the progress of the ship, using existing command and control facilities. According to DOD's Country Director for Japan, the costs of this monitoring were not explicitly tracked but were insignificant. He also noted that DOD did not deploy any equipment to support the shipment and therefore did not incur any operational costs.

Concerns Over Japan's Shipment and Increases in the World's Stocks of Plutonium

Japan's shipment raised immediate concerns about the physical security and safety of the plutonium cargo and revived long-term concerns about the amount of plutonium that is being and will be generated from commercial reprocessing and the uses to which that plutonium may be put. The more plutonium is recovered from spent fuel—and the more widely that plutonium is distributed throughout the world—the greater the risk of its diversion to states that do not have nuclear weapons. According to an official from DOE's Office of International Programs, by the year 2000, commercial reactors will have generated 240,000 metric tons of spent fuel containing over 1,100 metric tons of plutonium. In 1987, we reported that, internationally, concerns about the impact of reprocessing on proliferation had already been realized.³ In 1974, India exploded a nuclear device containing plutonium extracted from reprocessed research reactor fuel, and Israel's widely reported nuclear arsenal is believed to contain plutonium derived from a secret reprocessing facility.

Because of concerns about the November 1992 shipment to Japan, the Congress, in the Energy Policy Act of 1992 (P.L. 102-486), which was signed on October 24, 1992, required the President, in consultation with NRC, to conduct a study of the safety of shipments of plutonium by sea. The study was to determine (1) the safety of the containers holding the plutonium; (2) the safety risks to the states of such shipments; (3) upon the request of a state, the adequacy of that state's emergency plans with respect to such shipments; and (4) the federal resources needed to assist the states on account of such shipments. Furthermore, the President was to submit the report with his recommendations no later than 60 days after the act's enactment.

We obtained a December 1992 draft of the report, which was coordinated by the State Department and compiled by DOE, NRC, the Coast Guard, the Department of Transportation, the Environmental Protection Agency, and the Federal Emergency Management Agency (FEMA). In general, the draft

³Department of Energy Needs Tighter Controls Over Reprocessing Information (GAO/RCED-87-150, Aug. 17, 1987).

report reiterated standards and regulations for sea transport, discussed the results of past studies on shipping radioactive materials by sea, and concluded that plutonium could be shipped safely by sea when shipments were carried out in compliance with existing international and national regulations. The draft report did not contain an evaluation by NRC of the containers used for shipping the plutonium but noted that they had been tested by French and Japanese officials and by several European authorities and had met IAEA requirements.

The draft report concluded that no federal resources were needed to assist the states in preparing an appropriate response to an accident involving plutonium. The draft report also recommended that FEMA review coastal states' emergency plans upon request by such states and that, in preparing budget submissions for fiscal years 1994 and beyond, federal agencies take into account the need for any federal resources identified in FEMA's evaluation of state plans. As of May 1993, the report had not been submitted to the Congress.

Foreign Officials Express Concern

The ministries of several countries sent letters to Japan's government expressing concern about the shipment and requesting that it not enter their territorial waters. Environmental and citizens' groups created substantial worldwide publicity, expressing concern about the environmental safety of the shipment and the safety and integrity of the transport containers holding the plutonium. Before the ship departed, Greenpeace International notified countries of routes that it could take, monitored its progress once it was under way, and warned countries of its passing. We discussed these concerns with the First Secretary of Japan's embassy and with representatives of PNC. PNC officials told us that in the event of an accident, the corporation, with the financial support of the government of Japan, would be liable for all damages and/or losses.

To counteract adverse publicity, the U.S. State Department and the governments of France and Japan issued statements describing, in general terms, the transport container (packaging) and the steps taken to protect the physical security and safety of the transport ship. Both French and Japanese government officials held separate news conferences to assure the public that the shipment was physically secure and safe. In addition, the State Department provided similar information through U.S. embassies for concerned foreign governments.

Commercial Reprocessing Is Increasing the World's Stocks of Plutonium

Recently, both U.S. and British government officials have expressed concern about the amount of plutonium that is and will be generated from commercial reprocessing plants. According to DOD's former Deputy for Non-Proliferation Policy, the risks of proliferation posed by reprocessing and separated plutonium under international safeguards are unacceptable. Similarly, British government officials told us that while environmental and economic issues surrounding reprocessing are important, proliferation is a major concern.

Commercial reprocessing contracts are generating large amounts of separated plutonium. From 1987 to 1992, for example, stocks of plutonium held under international safeguards by BNFL and its overseas customers steadily increased from 14 metric tons to 23.5 metric tons. This plutonium is either unextracted from spent fuel and kept in storage ponds or separated as plutonium oxide powder.

At present, BNFL is trying to obtain a license from the British government to begin operations at its recently completed thermal oxide reprocessing plant (THORP) in Sellafield, England. Licensing THORP has sparked much debate among government officials and environmentalists in the United Kingdom and abroad. British officials told us that current contracts are profitable enough to cover the operating costs of THORP, but if the government does not license the plant, an investment of 1 billion British pounds will be lost. However, one British government official told us that the rationale for operating THORP is no longer valid because THORP cannot be a financially successful venture. He further contended that without economic justification to engage in commercial reprocessing, the basis for reprocessing in the United Kingdom has collapsed. The British government is weighing nonproliferation, environmental, and economic information in deciding whether to grant or deny THORP an operating license.

Agreement Between U.S. and Japan Sets Precedent

The Agreement for Cooperation Between the United States and Japan Concerning Peaceful Uses of Nuclear Energy built upon precedents set by previous U.S. agreements for cooperation with Norway, Finland, and Sweden. Under these agreements, the United States gave prior consent to these countries to transfer and reprocess spent fuel of U.S. origin in France and the United Kingdom. However, the United States must provide consent on a case-by-case basis for the return of separated plutonium to these countries under what is called the subsequent arrangement process. This process gives the U.S. Congress 15 legislative days to consider the

subsequent arrangement. After 15 days, the subsequent arrangement automatically takes effect unless the Congress modifies or disapproves it. By providing for consent on a case-by-case basis, these agreements allow the United States to consider whether the return of plutonium will take place under conditions that ensure timely warning of any diversion well in advance of the time at which a nonnuclear weapon state could transform the material into a nuclear explosive device.

The Agreement between the United States and Japan went beyond these precedents by also including prior consent for 30 years for the return of separated plutonium to Japan. No other country has such an agreement with the United States. However, other agreements concerning nonproliferation and the transportation of nuclear materials will be coming up for consideration before the Congress, and these agreements may incorporate similar language.

Advance Approval Provides the Congress With Fewer Oversight Opportunities

The Implementing Agreement that accompanies the Agreement provides blanket approval for reprocessing and for the return of recovered plutonium from third countries to Japan. Hence, the Agreement leaves the United States with little effective control over these activities for the 30-year life of the Agreement. Unlike in the agreements between the United States and Norway, Finland, or Sweden, the Congress is not given the opportunity to modify or disapprove the return of plutonium on a case-by-case basis, and therefore its oversight opportunities are diminished. Although there was some congressional opposition to the 30-year advance consent, the Congress did not take action to block the Agreement. In a 1988 legal analysis of the then-proposed Agreement, we found that

The United States would have to rely solely on the monitoring of these activities by the executive branch, as opposed to before-the-fact determinations made through the subsequent arrangement process. The United States would also have to rely on its ability in the extreme case to terminate the proposed Agreement or suspend the Implementing Agreement to ensure that the reprocessing within Japan and the return of plutonium to Japan, does not, over the 30-year Agreement, create increased risks of proliferation. Further, advance approval deprives the Congress of its oversight function.⁴

As a result, unless Japan breaches the Agreement or engages in activities that result in an increase in the risk of proliferation, the United States will not terminate the Agreement. U.S. officials told us that terminating the

⁴B-230201, Feb. 29, 1988 (p. 3).

Agreement would seriously disrupt U.S. diplomatic relations with Japan. These officials also said that Japan has no intentions of pursuing a nuclear weapons program as a result of developing a policy for utilizing plutonium in commercial reactors.

Other countries have expressed interest in advancing their nuclear reactor programs through similar agreements for cooperation with the United States. Officials from the State Department's Office of Nuclear Technology and Safeguards told us that even though the United States is not open to reprocessing outside of Japan and the EURATOM⁶ countries, it is important to maintain an open dialogue with the countries that request reprocessing technologies. According to these officials, although the United States strongly discourages reprocessing in other countries, it may in some cases provide alternative nuclear technologies to satisfy related needs. For example, if a country requests reprocessing technology to dispose of spent fuel, U.S. officials may provide alternative spent fuel disposition technologies.

Recently, for example, South Korea renewed its request for reprocessing technology from the United States. Although State Department officials told us that the United States has not provided reprocessing technology to South Korea and does not believe that South Korea should acquire it, they are cooperating with South Korea in developing other nuclear technologies. For example, U.S. officials are cooperating with South Korea in developing liquid metal technology—a cooling technology common to all breeder reactors.⁶ Similarly, an official from the State Department noted that the United States has reviewed a plan that would enable South Korea to reuse spent fuel of U.S. origin in Canadian-built heavy water reactors and, in principle, has agreed to the process. The initial steps in this process are the same as in reprocessing technology. However, the official explained, this technology is not reprocessing because the plutonium is not separated out from the waste.

DOD's former Deputy for Non-Proliferation Policy told us that the United States should aid South Korea in developing only light water reactor technology, not any sensitive nuclear technologies. He also stated that by persisting in its plutonium use policy, Japan set a bad precedent for North

⁶EURATOM, the European Atomic Energy Community, is a group of western European countries organized in 1957 to ensure, among other things, the development of nuclear activities in the Community framework.

⁶Breeder reactors require reprocessing of current and future stocks of spent reactor fuel in order to obtain the necessary plutonium as fuel. Breeder reactors produce more fuel (plutonium) than they consume.

and South Korea that will complicate U.S. discussions on reprocessing with them.

At the same time, however, both France's Cogema and the United Kingdom's BNFL have offices in Seoul, South Korea, whose main objective is to sell reprocessing services and technology. The State Department official told us that international nuclear agreements between South Korea and other countries accord those other countries consent rights over the transfer of sensitive nuclear technology to South Korea and the reprocessing of spent fuel. The United States is monitoring this situation.

Conclusions

The safe arrival of the Akatsuki Maru in Japan ended approximately 2 months of concern over the physical security and safety of Japan's plutonium shipment. Before the transport ship began its voyage, U.S. officials were satisfied that all possible precautions had been taken to ensure a secure and safe voyage. U.S. and Japanese officials had coordinated the transportation plan and negotiated improvements in the shipment's safety and security measures, and during the transport they had jointly monitored the ship's location. U.S. officials also said that the costs to the U.S. government of monitoring the shipment were minimal. However, despite the precautions taken, government officials around the world, including Members of the U.S. Congress, expressed concern about the risk of terrorist attacks or accidents posed by this shipment and by future shipments.

Japan's shipment also raised or revived broader concerns about the growth of plutonium stocks around the world and the increasing risk of nuclear proliferation. Like Japan, other countries have expressed interest in advancing their nuclear reactor programs through agreements for cooperation with the United States. Although the United States does not want countries besides Japan and the EURATOM nations to develop reprocessing capabilities, it is willing to cooperate with other countries in developing alternative nuclear technologies.

The 1988 Agreement with Japan, which authorized the reprocessing of spent fuel and the commercial use of plutonium, may have implications for future agreements between the United States and other countries that use nuclear materials of U.S. origin. First, it suggests to other countries that the United States may, under certain conditions, allow other countries to reprocess spent fuel of U.S. origin and use the recovered plutonium for commercial purposes. Second, if the Congress allows similar agreements

with long-term advance consent, the Congress may lose the opportunity to review and approve other countries' reprocessing of spent fuel and transport of plutonium on a case-by-case basis, by assigning sole responsibility to executive branch agencies.

Matter for Congressional Consideration

In reviewing future agreements for nuclear cooperation between the United States and other countries, the Congress may wish to consider the impact of an agreement's terms on the Congress's opportunities for oversight and on the United States' nonproliferation goals.

Agency Comments

We discussed the facts presented in this report with the State Department's Deputy Assistant Secretary for Nuclear Energy and Energy Technology Affairs; NRC's Deputy Director, Safeguards and Transportation; DOD's Country Director for Japan, Office of International Security Affairs; DOE's Acting Director, Office of Non-Proliferation; and ACDA's Chief, Nuclear Safeguards and Testing Division. In general, these officials agreed with the facts presented and gave us additional clarifying information. We revised the text as necessary. However, as requested, we did not obtain written agency comments on a draft of this report.

Scope and Methodology

To address our objectives, we interviewed officials and reviewed documentation from the State Department, NRC, DOD, DOE, ACDA, the U.S. Coast Guard, and the Central Intelligence Agency. We also interviewed officials from ECO Engineering, Inc.; Greenpeace International; and the Nuclear Control Institute.

To better understand Japan's energy policy, we interviewed the First Secretary from Japan's embassy and officials from PNC in Washington, D.C. Because France provides reprocessing services for Japan and this shipment was made from Cherbourg, France, we interviewed an official from the French Atomic Energy Commission in Washington, D.C.

We also met with British officials from the Department of Trade and Industry, Her Majesty's Inspectorate of Pollution, and the Department of the Environment, as well as with BNFL representatives in London and in Sellafield, England, to discuss reprocessing and the current controversy in the United Kingdom concerning the licensing of its new reprocessing facility. Finally, we met with IMO's Senior Technical Officer and with IAEA's Senior Officer, Transport Safety, Division of Nuclear Safety, to better understand the responsibilities of these organizations in regulating the sea

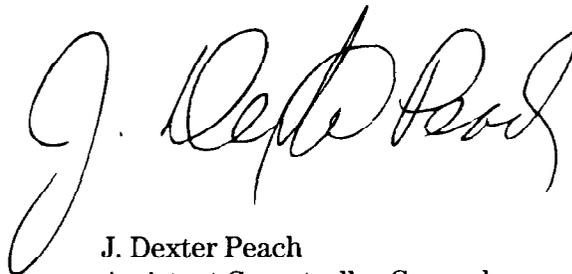
transport of nuclear materials and the current status of joint meetings with IAEA on this issue.

We performed our review between July 1992 and May 1993 in accordance with generally accepted government auditing standards.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from the date of this letter. At that time we will send copies of the report to appropriate congressional committees; the Secretaries of Defense, Energy, State, and Transportation; the Chairman, NRC; and the Director, ACDA. We will make copies available to others upon request.

This report was prepared under the direction of Victor S. Rezendes, Director, Energy and Science Issues, who may be reached at (202) 512-3841. Other major contributors to this report are listed in appendix III.

Sincerely yours,

A handwritten signature in black ink, appearing to read "J. Dexter Peach". The signature is written in a cursive style with a large initial "J" and a long, sweeping underline.

J. Dexter Peach
Assistant Comptroller General

International Standards for Transporting Nuclear Materials

Japan's Shipment Met or Exceeded International Standards

The packaging used to transport plutonium in the Akatsuki Maru from France to Japan was a French-manufactured container, known as the FS 47, which exceeds the International Atomic Energy Agency's (IAEA) packaging standards for nuclear materials, according to the Attaché for Nuclear Energy, French Atomic Energy Commission. The containers were tested in France and Japan and by several European competent authorities.¹ The FS 47 containers were not made specifically for the 1992 shipment. The Attaché told us that the FS 47 is used extensively by the French to transport plutonium within the European community.

According to French officials, the plutonium oxide was carried in short steel containers—each holding 7 pounds of the material. The containers were placed inside sealed steel tubes that were then placed into additional watertight tubes. These tubes were placed inside the 6-foot-high yellow FS 47 containers weighing 1.5 tons. The ship carried 133 such containers.

Japan's Marine Science and Technology Center conducted a water immersion test on the container to determine whether it could withstand pressures at a depth of 10,000 meters and determined that the integrity of the containment successfully withstood this pressure for about 20 minutes. The results of the Japanese test exceeded IAEA requirements for water immersion, which require containers of unirradiated nuclear material to be tested at a minimum depth of 15 meters for not less than 8 hours. Nuclear Regulatory Commission (NRC) officials told us that the container has been used for over 10 years in Europe, is not unusual in design, and was used in an earlier shipment of plutonium from France to Japan. However, NRC has not evaluated this container because no one has submitted an import application needed to allow the container to enter the United States.

International Regulatory Organizations Debate Safety Codes for Transporting Nuclear Materials

The International Maritime Organization (IMO) and IAEA are currently reviewing the regulations covering the transport of nuclear materials. In December 1992, IAEA and IMO officials met and formed a joint working group to discuss the regulatory aspects and responsibilities associated with marine transportation of irradiated materials. According to an IMO official, members of the regulatory community initiated the review

¹Competent authorities are entities designated by IAEA member states that are responsible for ensuring that IAEA standards are carried out. For example, the Department of Transportation is the U.S. competent authority.

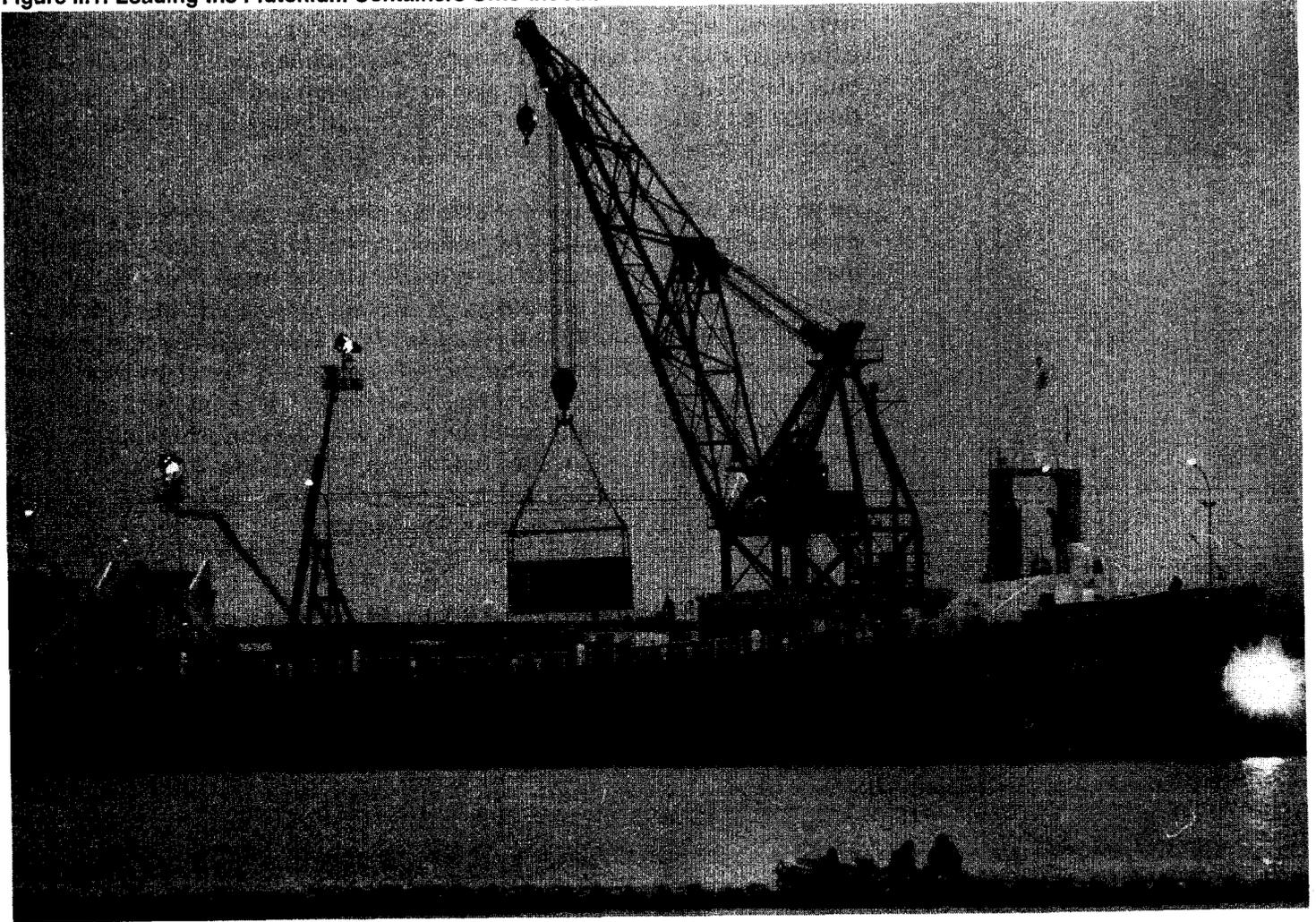
because they perceived that shipments of plutonium and high-level waste² were becoming more frequent. During the meeting, IMO and IAEA officials expressed a general opinion that safety regulations should be applied not only to irradiated materials but also to plutonium and high-level waste and that the sea transport of these materials should be made as safe as possible within the existing IMO and IAEA regulations.

An IMO joint working group official told us that the joint working group does not support the banning of plutonium transport and does not require that ships be specially built to transfer this kind of cargo. This official said that for the current IAEA and IMO safety regulations to work, there must be some regulatory flexibility in their application. This flexibility must extend to maintaining high levels of ship safety because very few ships have been built to transport plutonium and high-level waste. The joint working group met again in April 1993 and, according to a working group official, recommended that the Maritime Safety Committee adopt the draft irradiated nuclear fuel code and apply the code to plutonium and high-level waste in addition to irradiated material.

²High-level waste is generated during the production of electricity in nuclear power plants and is contained inside spent fuel assemblies along with the remaining uranium and plutonium. High-level waste has high levels of radiation. The IAEA/IMO working group is using this term to refer to the residual material from the extraction of plutonium and uranium by reprocessing.

Photographs of the Plutonium Transport and Escort Ships

Figure II.1: Loading the Plutonium Containers Onto the Akatsuki Maru in France.



Appendix II
Photographs of the Plutonium Transport
and Escort Ships

Figure II.2: The Escort Ship, Shikishima.



Major Contributors to This Report

Resources,
Community, and
Economic
Development
Division, Washington,
D.C.

Jim Wells, Associate Director
Gene Aloise, Assistant Director
Patricia J. Metz, Evaluator-in-Charge
Mary Alice A. Hayward, Evaluator

Office of the General
Counsel

Jackie A. Goff, Senior Attorney

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